CLAIMS

What is claimed is:

1. An alloy composition comprising in combination, by weight, about: 0.1 to 0.3% carbon (C), 8 to 17% cobalt (Co), less than 5% nickel (Ni), greater than 6 and less than 11% chromium (Cr), and less than 3% molybdenum (Mo), the balance essentially iron (Fe) and incidental elements and impurities.

2. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 240 ksi.

3. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 260 ksi.

4. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 280 ksi.

5. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 240 ksi and a yield strength (YS) greater than about 200 ksi.

6. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 260 ksi and a yield strength (YS) greater than about 215 ksi.

7. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 280 ksi and a yield strength (YS) greater than about 230 ksi.

8. The alloy of claim 1, having a martensite start (M_S) temperature as measured by quenching dilatometry and 1% transformation fraction, greater than about 150°C.

9. The alloy of claim 1, having a martensite start (M_S) temperature as measured by quenching dilatometry and 1% transformation fraction, greater than about 200°C.

10. The alloy of claim 1, having a martensite start (M_S) temperature as measured by quenching dilatometry and 1% transformation fraction, greater than about 250°C.

11. The alloy of claim 1, having more than about 85% by weight of the carbon (C) content of the alloy comprising M_2C carbides smaller than about ten nanometers, where M is selected from the group consisting of Cr, Mo, V, W, Nb, Ta and combinations thereof.

12. The alloy of claim 1, having more than about 85% by weight of the carbon (C) content of the alloy comprising M_2C carbides smaller than about five nanometers, where M is selected from the group consisting of Cr, Mo, V, W, Nb, Ta and combinations thereof.

13. The alloy of claim 1 formed with a Cr passivation surface layer and having an annual corrosion rate, as measured by linear polarization measurements in a 3.5% by weight aqueous sodium chloride solution, equivalent to or less than the rate determined for 15-5PH (H900 Condition) stainless steel.

14. The alloy of claim 1 formed with a Cr passivation surface layer and having an annual corrosion rate, as measured by linear polarization measurements in a 3.5% by weight aqueous sodium chloride solution, less than about 250% of the rate determined for 15-5PH (H900 Condition) stainless steel.

15. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 240 ksi and a martensite start (M_S) temperature as measured by quenching dilatometry and 1% transformation fraction, greater than about 200°C.

16. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 260 ksi and a martensite start (M_S) temperature, as measured by quenching dilatometry and 1% transformation fraction, greater than about 200°C.

17. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 280 ksi and a martensite start (M_S) temperature, as measured by quenching dilatometry and 1% transformation fraction, greater than about 200°C.

18. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 240 ksi and an annual corrosion rate, as measured by linear polarization measurements in a 3.5% by weight aqueous sodium chloride solution, less than about 250% of the rate determined for 15-5PH (H900 Condition) stainless steel.

19. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 260 ksi and an annual corrosion rate, as measured by linear polarization measurements in a 3.5% by weight aqueous sodium chloride solution, less than about 250% of the rate determined for 15-5PH (H900 Condition) stainless steel.

20. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 280 ksi and an annual corrosion rate, as measured by linear polarization measurements in a 3.5% by weight aqueous sodium chloride solution, less than about 250% of the rate determined for 15-5PH (H900 Condition) stainless steel.

21. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 240 ksi and an annual corrosion rate, as measured by linear polarization measurements in a 3.5% by weight aqueous sodium chloride solution, equivalent to or less than the rate determined for 15-5PH (H900 Condition) stainless steel.

22. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 260 ksi and an annual corrosion rate, as measured by linear polarization measurements in a 3.5% by weight aqueous sodium chloride solution, equivalent to or less than the rate determined for 15-5PH (H900 Condition) stainless steel.

23. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 280 ksi and an annual corrosion rate, as measured by linear polarization measurements in a 3.5% by weight aqueous sodium chloride solution, equivalent to or less than the rate determined for 15-5PH (H900 Condition) stainless steel.

24. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 240 ksi and where more than about 85% by weight of the carbon content of the alloy is found in M_2C carbides smaller than about ten nanometers, where M is selected from the group consisting of Cr, Mo, V, W, Nb, Ta and combinations thereof.

25. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 240 ksi and where more than about 85% by weight of the carbon content of the alloy is found in M_2C carbides smaller than about five nanometers, where M is selected from the group consisting of Cr, Mo, V, W, Nb, Ta and combinations thereof.

26. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 260 ksi and more than about 85% by weight of the carbon content of the alloy is found in M_2C carbides smaller than about ten nanometers, where M is selected from the group consisting of Cr, Mo, V, W, Nb, Ta and combinations thereof.

27. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 260 ksi and more than about 85% by weight of the carbon content of the alloy is found in M_2C carbides smaller than about five nanometers, where M is selected from the group consisting of Cr, Mo, V, W, Nb, Ta and combinations thereof.

28. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 280 ksi and more than about 85% by weight of the carbon content of the alloy is found in M_2C carbides smaller than about ten nanometers, where M is selected from the group consisting of Cr, Mo, V, W, Nb, Ta and combinations thereof.

29. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 280 ksi and more than about 85% by weight of the carbon content of the alloy is found in M_2C carbides smaller than about five nanometers, where M is selected from the group consisting of Cr, Mo, V, W, Nb, Ta and combinations thereof.

30. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 240 ksi, more than about 85% by weight of the carbon content of the alloy is found in M_2C carbides smaller than about ten nanometers, where M is selected from the group consisting of Cr, Mo, V, W, Nb, Ta and combinations thereof, where the martensite start (M_S) temperature of the alloy as measured by quenching dilatometry and 1% transformation fraction, is greater than about 150°C, and an annual corrosion rate, as measured by linear polarization measurements in a 3.5% by weight aqueous sodium chloride solution, less than about 250% of the rate determined for 15-5PH (H900 Condition) stainless steel.

31. The alloy of claim 1 having an ultimate tensile strength (UTS) greater than about 240 ksi, more than about 85% by weight of the carbon content of the alloy is found in M_2C carbides smaller than about five nanometers, where M is selected from the group consisting of Cr, Mo, V, W, Nb, Ta and combinations thereof, where the martensite start (M_S) temperature of the alloy as measured by quenching dilatometry and 1% transformation fraction, is greater than about 150°C, and an annual corrosion rate, as measured by linear polarization measurements in a 3.5% by weight aqueous sodium chloride solution, less than about 250% of the rate determined for 15-5PH (H900 Condition) stainless steel.

X 32. The alloy of claim 1 wherein said alloy contains one or more elements comprising less than 1% silicon (Si), less than 0.3% niobium (Nb), less than 0.8% vanadium (V), less than 3% tungsten (W), less than 0.2% titanium (Ti), less than 0.2% lanthanum (La) or other rare earth

elements, less than 0.15% zirconium (Zr), and less than 0.005% boron (B), percentages being by weight.

33. The alloy of claim 1 wherein said alloy contains less than about: 0.02% sulfur (S), 0.012% phosphorus (P), 0.015% oxygen (O) and 0.015% nitrogen (N), percentages being by weight.

34. The alloy of claim 1 wherein said alloy comprises a substantially lath martensite phase.

35. The alloy of claim 1 wherein said alloy comprises Cr and Co in combination with M_2C carbides to provide a Cr rich corrosion resistant passivation layer.

36. The alloy of claim 1 further comprising a gettering compound and a grain boundary cohesion enhancing element.

37. The alloy of claim 1 further comprising a gettering compound of La_2O_2S or Ce_2O_2S.

38. The alloy of claim 1 further comprising a grain boundary cohesion enhancing element selected from the group consisting of B, C and Mo.

39. The alloy of claim 1 further comprising M_2C carbide precipitates smaller than about ten nanometers average diameter as hydrogen transport inhibitors.

40. The alloy of claim 1, wherein no more than about 10% by weight of the carbon content of the alloy is found in primary MC carbides larger than about ten nanometers, where M is selected from the group consisting of Ti, V, Nb, Mo, Ta and combinations thereof.

41. The alloy of claim 1, where no more than about 2% by weight of the carbon content of the alloy is found in carbides larger than about seventy-five nanometers, and the carbides are selected from the group consisting of M_6C, M_7C_3, $M_{23}C_6$, M_3C, and M_2C, where M is selected from the group consisting of Fe, Cr, Mo, V, W, Nb, Ta, and Ti and combinations thereof.

42. The alloy of claim 1, wherein no more than about 5% by weight of the carbon content of the alloy is found in MC carbides larger than about ten nanometers, and M is selected from the group consisting of Cr, Mo, V, W, Nb, Ta, Ti and combinations thereof.

43. The alloy of claim 1, wherein the alloy is solution heat treated at a metal temperature within about 850°C and 1200°C.

44. The alloy of claim 1, wherein the alloy is solution heat treated at a metal temperature within about 950°C and 1100°C.

45. The alloy of claim 1, wherein the alloy is cooled from the solution heat treatment to about room temperature to form a predominantly lath martensitic structure.

46. The alloy of claim 1, wherein the alloy is cooled from a solution heat treatment to about room temperature and then further cooled from about room temperature to a metal temperature less than about -70°C to form a predominantly lath martensitic structure.

47. The alloy of claim 1, wherein the alloy is cooled from the solution heat treatment to about room temperature and then further cooled from about room temperature to a metal temperature less than about -195°C to form a predominantly lath martensitic structure.

48. The alloy of claim 1, wherein the alloy is tempered in one or more steps at a metal temperature less than about 600°C and the alloy is cooled between steps to form a predominantly lath martensitic structure.

49. The alloy of claim 1, wherein the alloy is tempered in one or more steps at a metal temperature less than about 300°C and the alloy is cooled between steps to form a predominantly lath martensitic structure.

50. The alloy of claim 1, wherein the alloy is tempered in one or more steps at a metal temperature less than about 400°C and the alloy is cooled between steps to form a predominantly lath martensitic structure.

51. The alloy of claim 1, wherein the alloy is tempered in one or more steps at a metal temperature within about 400°C and 600°C and the alloy is cooled between steps to form a predominantly lath martensitic structure.

52. The alloy of claim 1, wherein the alloy is tempered in one or more steps at a metal temperature within about 475°C and 525°C and the alloy is cooled between steps to form a predominantly lath martensitic structure.

53. The alloy of claim 1, wherein the alloy is tempered to a hardness greater than about 53 Rockwell C.

54. The alloy of claim 1, wherein the alloy is tempered to a hardness greater than about 50 Rockwell C.

55. The alloy of claim 1, wherein the alloy is tempered to a hardness greater than about 45 Rockwell C.

56. The alloy of claim 1, wherein the alloy is case hardened to a surface hardness greater than about 67 Rockwell C.

57. The alloy of claim 1, wherein the alloy is case hardened to a surface hardness greater than about 60 Rockwell C.

58. The alloy of claim 1, wherein the alloy has a toughness/strength ratio, K_{Ic}/σ_y, greater than or equal to about $0.21\sqrt{in}$, where K_{Ic} is the fracture toughness of the alloy and σ_y is the yield strength.

59. A method of producing an ultrahigh-strength, corrosion resistant, structural steel alloy product comprising the steps of:

(a) combining a mixture of elements in a melt comprising, by weight, about: 0.1 to 0.3% carbon (C), 8 to 17% cobalt (Co), less than 5% nickel (Ni), greater than 6 and less than 11% chromium (Cr), and less than 3% molybdenum (Mo), the balance essentially iron (Fe) and incidental elements and impurities; and

processing said melt mixture to form an article of manufacture.

60. The method according to claim 59 wherein said steel alloy product is formulated to contain one or more elements from the group comprising about: less than 1% silicon (Si), less than 0.3% niobium (Nb), less than 0.8% vanadium (V), less than 3% tungsten (W), less than

0.2% titanium (Ti), less than 0.2% lanthanum (La) or other rare earth elements, less than 0.15% zirconium (Zr), and less than 0.005% boron (B), percentages being by weight.

61. The method according to claim 59 wherein said steel alloy product is formulated to contain less than about: 0.02% sulfur (S), 0.012% phosphorus (P), 0.015% oxygen (O) and 0.015% nitrogen (N), percentages being by weight.

62. The method according to claim 59 wherein the step of processing said steel alloy product comprises:

(a) homogenization of said steel alloy article;

(b) hot working said steel alloy article;

(c) normalizing said steel alloy article; and

(d) annealing said steel alloy article.

63. The method according to claim 62 wherein said homogenization is at a metal temperature within about 1100°C to 1400°C for at least four hours.

64. The method according to claim 62 wherein said homogenization is at a metal temperature within about 1200°C to 1300°C for at least four hours.

65. The method according to claim 62 wherein said hot working is at a metal temperature within about 840°C to 1300°C and results in a total reduction in cross sectional area of at least about five to one.

66. The method according to claim 62 wherein said hot working is at a metal temperature within about 1030°C to 1200°C and results in a total reduction in cross sectional area of at least about five to one.

67. The method according to claim 62 wherein said normalizing is at a metal temperature within about 880°C to 1100°C.

68. The method according to claim 62 wherein said normalizing is at a metal temperature within about 980°C to 1080°C.

69. The method according to claim 62 wherein said annealing is at a metal temperature within about 600°C to 850°C for more than one hour.

70. The method according to claim 62 wherein said annealing is at a metal temperature within about 650°C to 790°C for more than one hour.

71. The method according to claim 59 wherein the step of processing said steel alloy product comprises:

(a) homogenization of said steel alloy article;

(b) hot working said steel alloy article; and

(c) annealing said steel alloy article.

72. The method according to claim 71 wherein said homogenization is at a metal temperature within about 1100°C to 1400°C for at least four hours.

73. The method according to claim 71 wherein said homogenization is at a metal temperature within about 1200°C to 1300°C for at least four hours.

74. The method according to claim 71 wherein said hot working is at a metal temperature within about 840°C to 1300°C and results in a total reduction in cross sectional area of at least about five to one.

75. The method according to claim 71 wherein said hot working is at a metal temperature within about 1030°C to 1200°C and results in a total reduction in cross sectional area of at least about five to one.

76. The method according to claim 71 wherein said annealing is at a metal temperature within about 600°C to 850°C for more than one hour.

77. The method according to claim 71 wherein said annealing is at a metal temperature within about 650°C to 790°C for more than one hour.

78. The method according to claim 62 wherein said steel alloy article is further processed by the steps of:

(a) solution heat treatment of said steel alloy article;

(b) cooling said steel alloy article; and

(c) tempering said steel alloy article.

79. The method according to claim 78 wherein said solution heat treatment is at a metal temperature within about 850°C to 1100°C.

80. The method according to claim 78 wherein said solution heat treatment is at a metal temperature within about 950°C to 1050°C.

81. The method according to claim 78 wherein said cooling is to about room temperature.

82. The method according to claim 78 wherein said cooling is to a metal temperature less than about -70°C.

83. The method according to claim 78 wherein said cooling is to a metal temperature less than about -195°C.

84. The method according to claim 78 wherein said tempering is in one or more steps at a metal temperature less than about 600°C and the steel alloy product is cooled between steps.

85. The method according to claim 78 wherein said tempering is in one or more steps at a metal temperature less than about 500°C and the steel alloy product is cooled between steps.

86. The method according to claim 78 wherein said tempering is in one or more steps at a metal temperature less than about 400°C and the steel alloy product is cooled between steps.

87. The method according to claim 78 wherein said tempering is in one or more steps at a metal temperature less than about 300°C and the steel alloy product is cooled between steps.

88. The method according to claim 78 wherein said tempering is in one or more steps at a metal temperature within about 400°C to 600°C and the steel alloy product is cooled between steps.

89. The method according to claim 78 wherein said tempering is in one or more steps at a metal temperature within about 450°C to 540°C and the steel alloy product is cooled between steps.

90. The method according to claim 71 wherein said steel alloy article is further processed by the steps of:

(a) solution heat treatment of said steel alloy article;

(b) cooling said steel alloy article; and

(c) tempering said steel alloy article.

91. The method according to claim 90 wherein said solution heat treatment is at a metal temperature within about 850°C to 1100°C.

92. The method according to claim 90 wherein said solution heat treatment is at a metal temperature within about 950°C to 1050°C.

93. The method according to claim 90 wherein said cooling is to a metal temperature about room temperature.

94. The method according to claim 90 wherein said cooling is to a metal temperature less than about -70°C.

95. The method according to claim 90 wherein said cooling is to a metal temperature less than about -195°C.

96. The method according to claim 90 wherein said tempering is in one or more steps at a metal temperature less than about 600°C and the steel alloy product is cooled between steps.

97. The method according to claim 90 wherein said tempering is in one or more steps at a metal temperature less than about 500°C and the steel alloy product is cooled between steps.

98. The method according to claim 90 wherein said tempering is in one or more steps at a metal temperature less than about 400°C and the steel alloy product is cooled between steps.

99. The method according to claim 90 wherein said tempering is in one or more steps at a metal temperature less than about 300°C and the steel alloy product is cooled between steps.

100. The method according to claim 90 wherein said tempering is in one or more steps at a metal temperature within about 400°C to 600°C and the steel alloy product is cooled between steps.

101. The method according to claim 90 wherein said tempering is in one or more steps at a metal temperature within about 450°C to 540°Cand the steel alloy product is cooled between steps.

102. The method according to claim 59 wherein the processing includes the step of forming primarily M_2C carbides in the alloy where M is an element selected from the group consisting of Cr, Mo, V, W, Nb, Ta and combinations thereof.

103. The method according to claim 59 wherein said processing comprises heat treating to form a substantially martensitic phase material.

104. The method according to claim 59 wherein said processing comprises heat treating to form a majority of the carbon by weight as M_2C carbides where M is selected from the group consisting of Cr, Fe, Mo, V, W, Nb, Ta, Ti, and combinations thereof.

105. An alloy composition comprising, in combination, by weight, about: 0.2 to 0.26% carbon (C), 11 to 15% cobalt (Co), 2.0 to 3.0% nickel (Ni), 7.5 to 9.5% chromium (Cr), 1.0 to 2.0% molybdenum (Mo), and less than 0.8% vanadium (V), the balance essentially iron (Fe) and incidental elements and impurities.

106. An alloy composition comprising, in combination, by weight, about: 0.20 to 0.25% carbon (C), 12 to 15% cobalt (Co), 2.0 to 3.0% nickel (Ni), 7.0 to 9.0% chromium (Cr), 1.0 to 3.0% molybdenum (Mo), less than 2.5% tungsten (W), less than 0.75% silicon (Si), and less than 0.8% vanadium (V), the balance essentially iron (Fe) and incidental elements and impurities.

107. An alloy composition comprising, in combination, by weight, about: 0.10 to 0.20% carbon (C), 12 to 17% cobalt (Co), 2.5 to 5.0% nickel (Ni), 8.5 to 9.5% chromium (Cr), 1.0 to 2.0% molybdenum (Mo), and less than 0.8% vanadium (V), the balance essentially iron (Fe) and incidental elements and impurities.

108. An alloy composition comprising, in combination, by weight, about: 0.25 to 0.28% carbon (C), 11 to 15% cobalt (Co), 1.0 to 3.0% nickel (Ni), 7.0 to 9.0% chromium (Cr), less than 1.0% molybdenum (Mo), less than 1.0% silicon (Si), and less than 0.8% vanadium (V), the balance essentially iron (Fe) and incidental elements and impurities.

109. An alloy composition comprising, in combination, by weight, about: 0.22 to 0.25% carbon (C), 12 to 13% cobalt (Co), 2.5 to 3.0% nickel (Ni), 8.5 to 9.5% chromium (Cr), 1.0 to 1.5% molybdenum (Mo), and less than 0.8% vanadium (V), the balance essentially iron (Fe) and incidental elements and impurities.

110. An alloy composition comprising, in combination, by weight, about: 0.1 to 0.3% carbon (C), 8 to 17% cobalt (Co), 0 to 5% nickel (Ni), 6 to 12% chromium (Cr), less than 1% silicon (Si), less than 0.5% manganese (Mn), and less than 0.15% copper (Cu), with additives selected from the group consisting of about: less than 3% molybdenum (Mo), less than 0.3% niobium (Nb), less than 0.8% vanadium (V), less than 0.2% tantalum (Ta), less than 3% tungsten (W), and combinations thereof, with additional additives selected from the group consisting of about: less than 0.2% titanium (Ti), less than 0.2% lanthanum (La) or other rare earth elements, less than 0.15% zirconium (Zr), less than 0.005% boron (B), and combinations thereof, and the balance essentially iron (Fe) and incidental elements and impurities.

111. An alloy composition comprising in combination, by weight, about: 0.1 to 0.3% carbon (C), 8 to 17% cobalt (Co), 0 to 5% nickel (Ni), 6 to 12% chromium (Cr), less than 1% silicon (Si), less than 0.5% manganese (Mn), and less than 0.15% copper (Cu), with additives selected from the group consisting of about: less than 3% molybdenum (Mo), less than 0.3% niobium (Nb), less than 0.8% vanadium (V), less than 0.2% tantalum (Ta), less than 3% tungsten (W), and combinations thereof, with additional additives selected from the group consisting of about: less than 0.2% titanium (Ti), less than 0.2% lanthanum (La) or other rare earth elements, less than 0.15% zirconium (Zr), less than 0.005% boron (B), and combinations thereof, impurities of about less than 0.02% sulfur (S), 0.012% phosphorus (P), 0.015% oxygen (O) and 0.015% nitrogen (N), the balance essentially iron (Fe) and incidental elements and impurities.

112. An alloy as set forth in any of claims 106-112 having more than about 85% by weight of the carbon content of the alloy comprising M_2C carbides smaller than about ten nanometers in diameter where M is selected from the group consisting of Cr, Mo, V, W, Nb, Ta and combinations thereof.

113. An alloy as set forth in any of claims 106-112 having more than about 85% by weight of the carbon content of the alloy comprising M_2C carbides smaller than about five nanometers in diameter where M is selected from the group consisting of Cr, Mo, V, W, Nb, Ta and combinations thereof.

114. An alloy as set forth in any of claims 106-112 having an ultimate tensile strength greater than about 240 ksi.

115. An alloy as set forth in any of claims 106-112 having a yield strength greater than about 200 ksi.

116. An alloy as set forth in any of claims 106-112 including metal (M) carbide particles dispersed therein, said particles having the formula M_XC where $X \leq 2$ for the majority of weight percent of said particles, and wherein said alloy is predominantly in the martensitic phase.

117. An alloy as set forth in any of claims 106-112, wherein said alloy is in the martensitic phase and includes metal carbides dispersed therein, said metal carbides having a nominal dimension less than about ten nanometers in diameter and having a metal ion to carbon ion ratio predominantly in the range of about two to one or less.

118. An alloy as set forth in any of claims 106-112, wherein said alloy is in the martensitic phase and includes metal carbides dispersed therein, said metal carbides having a nominal dimension less than about five nanometers in diameter and having a metal ion to carbon ion ratio predominantly in the range of about two to one or less.

119. An alloy as set forth in any of claims 106-112, wherein said alloy has metal carbides dispersed therein where the ratio of the metal ion to the carbon ion is predominantly about two to one and wherein the metal is selected from the group consisting of Cr, Mo, V, W, Nb, Ta, Ti, and combinations thereof.

120. An alloy as set forth in any of claims 106-112, wherein said alloy has metal carbides dispersed therein, said metal selected from the group consisting of Cr, Mo, V, W, Nb, Ta, Ti, the ratio of the metal ion to the carbon ion is predominantly about two to one and the alloy is substantially in the martensite phase.

X 121. An alloy as set forth in any of claims 106-112, wherein said alloy has a nominal grain size equal to or smaller than about ASTM grain size number 5 (ASTM E112).

X 122. An alloy as set forth in any of claims 106-112, wherein said alloy is predominantly in the martensitic phase and has a nominal grain size equal to or smaller than about ASTM grain size number 5 (ASTM E112).